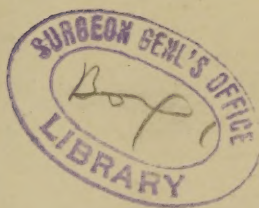


Batchelder (J.P.)

Pathology and treatment  
of the Paralysis of motion.

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PATHOLOGY AND TREATMENT  
OF  
THE PARALYSIS OF MOTION.

By J. P. Batchelder, M. D. New York.

WE do not consider the paralysis of which we are about to treat, a disease, but the symptom of one which mainly affects the voluntary muscles, or the muscles of animal life. The noncommunication of the appropriate stimulus to these muscles by the mind, constitutes the disease of which paralysis is the symptom. The muscles having ceased to act, form the habit of inactivity; and the mind, acquiescing from necessity or otherwise, contracts the habit of not communicating the necessary and appropriate stimulus to them through the nerves; so that, by the conjunction of these causes, additional morbid conditions of a secondary and somewhat chronic nature, have been induced, of which paralysis is also in this connection a symptom. As the removal of these cures the patient, we shall endeavor to ascertain and settle their pathology, from which we hope to be able to deduce the proper method of treatment. The performance of function induces a derivation of blood to an organ, which in a measure ceases when the function ceases; and the organ diminishes in size as the natural and almost inevitable consequence. This is a general law of the sys-

tem, to which the muscles of animal life, like all other organs, are subject; hence they become atrophied in paralysis, or when kept a considerable time at rest from other causes. Thus deprived of blood, their capillary vessels shrink, and what the capillaries of a part do, that will the part as a whole do. The atrophied muscles become shortened, and refuse to be elongated except by force; neither of which would have happened but for this shrinking of the capillaries.

In two points of view then is paralysis to be considered a symptom: 1—In relation to the function of the affected muscles. 2—In respect to their physical condition. Regarded in the former aspect, it is a sign that the connection between the mind and the muscles is interrupted; in the latter, it is an indication of the change which the muscles themselves have undergone. In the one case, it is a symptom of functional disease—in the other, of structural change, which consists of a general contraction of the muscular capillaries, and atrophy of the parenchyma of the affected muscles.

When a person is stricken down by a shock of apoplexy or palsy, the power of the nerves to stimulate the voluntary muscles to action is interrupted, because certain changes in the cerebral centre do not then take place; or if they do, corresponding changes in that portion of the peripheral brain (of which we shall presently speak), which is appropriated to the muscles of volition, do not occur, and paralysis of motion ensues.\*

This state of things may continue after the primary cause of the paralysis has been removed or ceased to operate; but the patient having been quiescent for a time, becomes acquiescent from habit, and will not make the slightest effort to move his limbs—indeed, insists that he cannot do it—that it is impossible. He has, as it were, forgotten how to produce the antecedent cerebral change as an act of the will;

\* By a parity of circumstances and reasoning, we would account for the existence of paralysis of sensation.



and the only way to enable him to recover the power or learn the art of doing it, is to cause the members to perform the motions calculated to produce the changes in the brain. The motions first and the changes in the cerebrum next, is the order and method of nature. By this expedient, duly performed and persevered in, he will at length be enabled to re-enact the cerebral change, and the movement of the limbs will follow in exact proportion to the energy with which this change in the brain is effected. Both, for obvious reasons, will be feeble at first; but he must be encouraged and helped; when by repetition, the efforts will be more and more vigorous, and the results more and more apparent and satisfactory.

In this way the functional disease is cured, and the structural affection is also finally removed by the same process. Exercise, as we all know, causes the muscles to increase in volume as well as power.

The paralytic, then, so far as the paralysis is concerned, is in much the same condition as the infant at birth; and in order to recover the use of his limbs, must go through a course of training somewhat analogous to that to which he was subjected when he first learned their use—his muscles must be re-educated. There is, however, this difference: the infant at birth is an idiot, (so far at least as mind and the performance of its functions are concerned,) while the subject of paralysis has some intellectual capital to begin with; but very little after all, so far as the affected part is concerned. There is another point of difference between the child and the paralytic, which savors strongly of contrast, and is in favor of the former, who is imbued with an instinctive propensity to action—a restless activity, which nothing but positive fatigue or exhaustion can restrain; while in the latter, inertness and an indisposition to motion prevails, which is at first very difficult and sometimes almost impossible to overcome; but the muscles not having entirely lost their contractility, begin sooner or later to act and produce movements of the limbs, analogous to those which

occurred in infancy, and which now as then, awake the attention of the patient, and at length re-endow his paralyzed limbs with some degree of voluntary motion, which, without proper training, commonly stops vastly short of a cure.

In paralysis, the muscles are, as suggested, seldom wholly destitute of contractility, but the patient has lost the will and the power of making them contract. The doctrine, then, which forms the basis of our theory and treatment too, is, that the paralytic must again learn to use his limbs just as he learned to use them in infancy; but as he cannot begin, as did the infant, to move them; and as nature, having once performed her task, refuses to renew her labors, we must, therefore, substitute our own hands for hers, and move his limbs as she moved them at first, and like her, invoke and direct his attention to the motions thus effected. We must indeed go further, and endeavor to induce him to co-operate with and assist us in the work. While moving his limbs, we should try to concentrate his attention upon the principal muscles by which the motions we are causing to be made are naturally executed, and urge him to make those muscles contract. A good way of doing this is to place his hand over the muscles in our own limb which we wish to have brought into play in his, and make them contract with force. This expedient may be likewise resorted to in his own unaffected members.

It is better to begin with the least complicated motions, as simple flexion and extension of the arm at the elbow, which are done mainly by two muscles. These motions may be performed by the well limb, and the patient exhorted to attend to the operations of his own mind as well as to the movements of his limb. He may likewise be requested to fix his attention on the affected limb, and consider what he did in relation to the movement of the well limb, and what he desires and intends to do, and what he must actually do in order to make this limb imitate the movements of the other.

In a paralysis of some duration, the muscles of the palsied limbs are not all in the same predicament. Some are powerless; some are too strongly contracted; others, neither contracted nor powerless, are, nevertheless, quite ready to act, not in obedience to the will, but in opposition to those which can and do act somewhat in accordance with its dictates; but all the muscles, generally speaking, concur in disregarding the volitions of the patient.

From these different conditions of the muscles, the indications of cure may be deduced with strict logical and pathological propriety. They are:

1. To restore strength to the powerless muscles.
2. To overcome abnormal contraction in others.
3. To obviate or counteract the perverse action of such as act irregularly.
4. To renovate the will, and reconnect it with the affected muscles.

The first three indications point directly to the 4th, which is, in fact, the ultimate object aimed at.

### *Treatment.*

*First indication.*—To restore strength to the powerless muscles.

*Second indication.*—To overcome the inordinate contraction in others.

As these indications are, to some extent, answered by the same means, we propose to consider them in connection, so far, at least, as the sameness of treatment goes.

The muscles, in paralysis of the arm from lead, furnish a tolerably good example of both these conditions. The extensors are powerless—the flexors, over contracted.

In restoring tone to the powerless muscles, we resort, with great prospect of success, to an agent inherent in the muscles themselves, denominated “passive contraction” by modern physiologists. This power causes a muscle to contract and shorten whenever its origin and insertion have



become approximated. Muscles thus circumstanced, after a while resist with great energy all endeavors to elongate them, as every surgeon well knows who has had much to do with dislocations of long standing. In such and analogous cases, each entire muscle accommodates itself to the altered condition which obtains between its origin and insertion. To enable paralyzed muscles to recover their power, we avail ourselves of the knowledge of these results, and cause their origin and insertion to approach each other, and keep them in this position for a longer or shorter time, as the case may be, or until the muscular fasciculi have begun to contract and adapt themselves to the change. This is effected by mechanical appliances—as splints of suitable form, adapted and applied so as to maintain the parts in this condition till the muscles recover their tone. Take, for example, the paralyzed hand, before alluded to. A splint, wide as the hand, should be applied along the forearm, from near the elbow to the ends of the fingers. To this the palm should be bound with a roller, which, while it keeps the splint in place, does not in the least interfere with the movements of the wrist. To the loose end of the splint near the elbow a weight (a small bag of sand will do), sufficiently heavy to keep the hand and fingers fully extended in spite of the contracted flexors, except when they (the flexors) act in obedience to the will. When they have thus acted, the patient should endeavor, by making the extensors contract, to bring the hand back into a state of full extension, in which he will be assisted by the weight appended to the upper end of the splint. In order to give him fair play—in other words, to enable him to get rid of the uncalled for action of other muscles—we have found it expedient to let the forearm at the wrist rest in a sling, with the splint excluded. In this way all the principles we wish to have invoked may be summoned to our aid.

The contracted muscles, usually the antagonists of the powerless, must be elongated, and the limb put and kept in a position which will prevent the recurrence of their con-



tracted state. The position of the limb should be studied as well in reference to the latter as to the former class of muscles—thus accommodating the treatment alike to the first as well as to the second indication. The splint, properly adapted and applied, is the best and perhaps the only instrument required for the accomplishment of both these purposes. The hand and fingers should be brought to the proper degree of extension, and maintained in that state till the over contracted muscles have become fully elongated and given up the contest, and until the others also have recovered their power of contraction. The splint should be taken off several times a day, and the limb rubbed and moved slowly and gently in every direction for half an hour or longer, and again put up in the apparatus.

Whenever the limb is moved, the attention of the patient should be directed to the movement and to the muscles also, by which that movement is ordinarily accomplished, and his co-operation likewise invoked and insisted on. This point will be more particularly adverted to when we come to consider the 4th indication.

*Third indication.*—To obviate or overcome the perverse action of certain muscles.

The muscles to which we now allude, are neither powerless nor over contracted, but act with considerable force—not in obedience to the will, but in opposition to those which act according to its dictates.

The voluntary action of one set of muscles, excites involuntary contraction in another, by simply putting these last on the stretch. Nature's design in this is to give firmness and stability to the limbs while at rest, and steadiness to their movements when in action, without requiring any special heed on the part of the individual in order to secure the intended result. Why, in health, no inconvenience springs from this arrangement of nature, is accounted for on the principle that then the muscles, habitually active, and prompted by a lively volition, act with more force than those which are excited by the mere stimulus of extension ;

but in paralysis the tables are turned. The muscles are then actuated by an enfeebled will, and, inert from habit or disease, scarcely simulate voluntary motion, or perform it so inefficiently as to be overpowered by those which are excited by other stimuli. For example: whenever the patient thus circumstanced tries to extend the hand and fingers, the flexors will not only resist this effort, but actually bend both hand and fingers; or when he attempts to flex the arm at the elbow, various other motions not *designed in the programme*, will be performed. The muscles, thus put on the stretch, and acting independently and in full accordance with their own energetic propensities, overcome those which act merely in obedience to the enfeebled will of the paralytic. Hence the necessity for resisting the efforts of these froward agents, until they submit, or the former prevail, which is to be accomplished by such mechanical contrivances as are suited to each particular case.

*Fourth indication.*—To renovate the will and reconnect it with the affected muscles.

“At birth, the human infant,” without volition, voluntary power, or even mind, is “the very representative of weakness and imbecility,” but subsequently comes to be indued with these and other intellectual faculties. In what way, asks curiosity, is this effected? An interrogation of surpassing interest, in which general science and medical science, in special reference to our subject, are deeply concerned. Therefore both prompt to an enquiry into the manner in which these faculties are acquired.

In this investigation, we start with the declaration that the faculties in question are not original endowments by nature, but attainments acquired by the child itself through the medium and instrumentality of the muscles, with the co-operation of the nerves, which, like the muscles, never perform their appropriate function, unless excited by some agent, which is, in the case of both nerves and muscles, primarily the same—the blood.

The muscles of animal life begin to contract *in utero*; and

their contractions are repeated after birth with increased force, and in a short time begin to be perceived by the ultimate nerve fibres, the peripheral brain\* whose perceptions are transmitted through the nerve cords to the central brain, in which, owing to its immaturity, no very appreciable changes are at first produced; but when its structure becomes more mature, the transmitted influences excite changes which produce consciousness. Now, this consciousness is the inception of mind—the inauguration of intellect; and as often as the muscles contract, these changes in the central organ—the organ of mind—are repeated, and consciousness awakened, till the inchoate mind is instinctively directed to the part in which these contractions occur. And it is furthermore conceded that the direction of the mind to a part, causes a determination of blood to that part, and that the blood is the natural and primary stimulus which excites the

\* The nerves, from their exit through the apertures in the skull and spinal column, to their termination in the ultimate fibre, are enclosed in a sheath; but the branches into which these fibres break up are, like the primitive fibres within the brain and spinal marrow, destitute of neurilemma. The perceptive faculties of these termini are so modified by the substances with which they are in immediate contact, as to render them scarcely cognizant of changes not peculiar to those substances. Hence the nerves distributed to the muscles of animal life, take cognizance of those changes only which pertain to them and to them alone. These naked termini constitute what we denominate the peripheral brain, which, in every part perceives and takes cognizance of changes that occur in the immediately surrounding substances. It is highly probable that the nerves are only a continuation of the brain or nervous centres into all parts of the body. This view of the subject seems to be fairly and fully supported by analogy. “The so called nerves of pure sense—the olfactory, optic and auditory nerves—may more properly be regarded as portions of the brain itself, than as mere nerves, for they possess most of the anatomical characters of nervous centres. The intra-cranial portion of the first is as distinctly compounded of vesicular and fibrous matter as a convolution of the brain. In the peripheral expansion of the optic nerve, the retina, it will be hereafter shown that the vesicular elements of a nervous centre are as unequivocally present as in the olfactory bulb. As regards the auditory nerve, there are also some grounds for the statement that the vesicles of gray matter are deposited at its peripheral expansion in the internal ear.” Todd & Bowman’s Lectures, p. 205. The nerve cords, sheathed in the neurilemma, form the connecting medium between the peripheral and central brain, through which impressions are conveyed, consciousness awakened, and the mandates of the will transmitted to parts subject to its control.



muscles to act. Consequently, the mind repeatedly directed to any one or more of them, will cause it or them to contract.

This process is rendered more and more easy by repetition, and is finally perfected by habit, which the child sooner or later acquires. He also becomes conscious of the fact that when these changes (which directed the mind to certain muscles) took place in the brain, they were uniformly associated with certain movements of his limbs; and he moreover finds that contraction in certain muscles causes this or that limb to move. Consequently, when this or that motion is desired, he directs the mind to this or that muscle, and the desired motion immediately ensues—why or wherefore he cannot tell—nor is it necessary he should. Volition, thus commenced, is soon followed by the acquisition of voluntary power, and this by voluntary motion. The exercise of this power and its results become more and more precise and perfect, in the paralytic as well as in the child, according as the efforts are more or less frequently and judiciously made.

That this is the method to be pursued in educating the muscles, every one, we think, may satisfy himself, who will take the trouble to notice the trials made by the child while learning to use his limbs; or who will try the experiment of educating his own muscles to the performance of a series of motions to which they have not been accustomed.

Having acquired the power of moving his limbs, the child, although he continues to exercise it, soon forgets the process by which it was obtained, but nevertheless continually resorts to it in after life, whenever any new or unpracticed operation is to be performed. To restore motion to muscles and re-educate them, as in cases of palsy (and some other affections we might add), and give the will\* dominion

\* "That mental state which produces or resists motion, is the will. When it exists, it first produces motion—change of condition (motion) in the capillaries of the brain, at the origin of certain nerves, and if persisted in, produces change of condition (motion again) in the peripheral extremities of those nerves, and the movement of the limb ensues." We cannot say to whom the

over their action, we must, we repeat, adopt the plan of first impressing passive motion on the limbs, and endeavor to keep the patient's attention fixed on the movements, and also on the muscles, by which these movements are ordinarily made, and moreover put forth his mental as well as physical energies and efforts to make those muscles contract.

### *Of Medication.*

*Electricity, galvanism and strychnine* are the principal remedies which at the present day are most relied on in the treatment of paralysis. They have been, it has seemed to us, rather empirically employed, the principles on which their use is based not having been very plainly declared, or clearly illustrated. They should, we think, be used mainly for the purpose of exciting motions in the paralyzed limbs analogous to the primary movements in early infancy, to which the attention of the paralytic should be directed, and of which he should avail himself in recovering the use of his limbs, just as he did when he first acquired a mastery over them. In accordance with these principles, electricity and galvanism ought to be employed at first with great caution, and in the gentlest manner possible, the object being to produce effects very like the primitive action of the muscles. Like the primitive actions, these effects may be cautiously increased. The motions caused by these agents may be beneficial by retarding or preventing the atrophy of the affected muscles. To avoid doing irreparable mischief as well as to obtain all the benefit to be derived from these agents, we repeat with solicitude the injunction that their influence should be very slight, scarcely perceptible at the beginning, and increased as the cure progresses. By neglecting this precaution, and applying these remedies too strongly at the commencement, the excitability still remain-

above quotation should be accredited. Our doctrine is, that the primordial change is in the peripheral extremities of the motor nerves, and that the motions of the limbs communicated through the nerve cords to the central brain give rise to the changes in that organ productive of thought.

ing in the muscles will be extinguished, and the hopes of the patient blasted forever.

One important item in the use of these agents must not be omitted, which is, that the patient's attention be continually invoked. Whenever an application is about to be made, he should be apprised of it, and prepared for it, and exhorted to prolong the motion excited; for the influence of concentrated attention, when accompanied with the expectation of change, in modifying organic functions, is an important agent in effecting cures in this affection. Therefore, the patient should be convinced of the necessity of this, in order to secure all the benefit which may be derived from these remedies.

*Strychnine*.—This most singular drug causes motions in the paralyzed limbs, which, like those produced by electricity and galvanism, somewhat resemble the primitive movements already alluded to, and of which we should avail ourselves in the treatment, very much after the manner suggested in relation to the last mentioned agents. The patient ought to be admonished to prolong these excited actions when they come; but they cannot be anticipated; for when slight, they are preceded by no premonitory sensation;\* but when strong, as when caused by large doses, one-third or half a grain of the drug three times a day, they are always preceded by an indescribable sensation in the muscles—as if they were alive—or a sort of crawling, immediately following which is the jerk or spasm. We should endeavor to

\* The premonitory symptom of tetanus is a stiffness of the thighs and legs in the morning on first waking, which goes off in a short time—to be returned the next morning. During this day or the next this terrible disease declares itself in an unmistakable manner. A similar rigidity of the lower extremities is in some instances a premonition of the more general action of the strychnine, and admonishes the reduction of the dose, or suspension, for a while at least, of the drug. In all cases in which tetanus is to be apprehended, enquiries should be made every morning by the medical attendant respecting this stiffness, as it is not apt to be mentioned by the patient, on account of its having soon ceased to affect him. He should be purged with calomel, and put and kept under the decided effect of opium. By so doing I am well satisfied that the tetanic affection may be, sometimes at least, prevented.



make the same use of these as was made of the primal motions by the child in its early infancy. By omitting to adopt the course suggested, less benefit will accrue to the patient from the use of this medicine than he would otherwise experience.

By way of illustration, we introduce the following case :

J. B\*\*\* aged 26 years, returned from a sea voyage about the middle of March 1854, enjoying good health. A few weeks previous, while on the coast of South America, he experienced a strange, indescribable sensation in his head, mostly about the crown and right side, which could not be called a pain, but seemed more like dizziness than any thing else. For this an English physician was consulted, who prescribed cathartic pills, and a blister to the nape of the neck, which greatly relieved him—so much so that when he arrived in this country he thought himself well, and continued so until the middle of May, when the same disagreeable feeling returned, and kept getting worse, till at the end of a week he was obliged to take his bed, seemingly more from a sense of general weakness than from any other cause. In a short time (he does not distinctly recollect how long) he lost the use of the right arm and leg and right side of his face; the symmetry of which was disturbed by the traction of the features to the opposite side. He could masticate tolerably well, but could not swallow without danger of suffocation. To avoid this, he adopted the expedient of holding the morsel in the back part of the mouth till the parts seemed to have completed their arrangements for deglutition, before he made the attempt—a practical hint, worthy of consideration in analogous cases.\* Other complications, as constipation and retention ensued, and were as usual followed by incontinence of urine and involuntary discharge of pus.

\* The cause of the difficulty of swallowing was the lodgment of the matter to be swallowed in the paralyzed side of the fauces; and the arrangements spoken of in the text consisted in dislodging and transferring it to the unaffected side. Until this was done, the unaffected muscles, in their action to cause the morsel to pass into the œsophagus, would only force it upon the glottis and upper part of the larynx.

He was confined to the bed about twenty-two weeks; at the end of which, he was taken out of bed by two persons, placed upon his feet, assisted to stand and step a little, and soon marched several times a day into the hall. In a month he was able to move about with a cane, and shortly ventured into the street alone. When I first saw him, October 1st, 1856, he walked as persons in his condition generally do—swaying the body to the opposite side and swinging the diseased limb round in order to bring the foot forward, while the arm which hung loose and useless by his side, was moved much in the same way, but could be moved somewhat in various directions by the muscles about the shoulder; mostly, however, in opposition to the will. The same was likewise true in relation to the movements of the forearm. The flexors of the wrist and fingers were so obstinately contracted that it required much force to straighten either—in fact he was obliged to take his arm in one hand near the wrist, and hand in the other, and place his knee against the back of the wrist in order to bring the hand and fingers fairly in a line with the forearm, or carry them backward so as fully to elongate the flexors. The thigh could be only half flexed on the pelvis, but not carried backward; and the leg but slightly flexed on the thigh. He could not indeed lift the afflicted foot from the ground, while the body was kept in an upright posture, and the thigh in a line with the body. The mouth was still somewhat drawn to the left side. The speech, although much improved, was still faulty; but pressure with the hand on the right cheek enabled him to articulate much better. Deglutition was not quite easy, but much less difficult than at first. Blowing, smiling and laughing were mostly on one side of the mouth, and whistling entirely out of the question. Previous to July 1851, when he first went to sea, he had lived very irregularly—intemperately and incontinently—had contracted syphilis, which went through its several forms—primary, secondary and tertiary; but during his seafaring life he had little to do with women. In boyhood and subsequently he was much in the habit of masturbating and

has now not unfrequently nocturnal emissions. In addition to all his other difficulties, this poor fellow is apparently far gone in consumption.

On the 2d day of October last he came under my care for the treatment of the paralysis, and visited my office nearly every day for two weeks, when he was attacked with what proved to be an abscess near the anus, which confined him to the house three weeks, and much of that time to the bed; during which I did not see him, having forgotten to take his address. After the bursting of this abscess, which ultimately terminated in a complete fistula in ano, he resumed his visits, and continued to do so until the weather became so cold as to render it imprudent for him to come out, except on very pleasant days. Consequently, I saw him a few times only during the month of December. He seemed to come with reluctance, which, with the fact that amendment had almost ceased, led me to suspect that the course of treatment to be pursued at home had been neglected, which was the fact.

In hemiplegia and paraplegia also, the muscles arising from the trunk and inserted into the limbs below, are those in which the recuperative process first begins and progresses most rapidly; and those of the inferior extremities recover sooner than those of the upper.\* Hence, these patients generally, perhaps always, commence walking before they have regained the power of using the arms and hands.† The

\* Of this seemingly unimportant fact, a very important advantage may be occasionally taken in the treatment of paraplegia, in many cases of which we shall find on close examination, that the muscles arising from the trunk and inserted into the limbs below, have to some extent partially recovered a contractile power, or were not from the first wholly deprived of contractility. This is apt to be the case when paraplegia occurs in infancy or childhood. In such, and we are inclined to think in all cases in which this state of the muscles obtains, the patient may by the help of a suitable apparatus and other appliances and means, be made to walk with a tolerable degree of satisfaction and usefulness.

† Probably this is attributable to the fact that patients are usually soon placed upon their feet, and compelled, as it were, to make an effort to stand and walk; in which case the weight of the body excites the muscles belonging to and connected with the inferior extremities to early and somewhat energetic action,



truthfulness of these statements was very manifest in our case.

To direct and fix his attention upon the muscles to be brought into action, and likewise upon the motions to be impressed on the lower limb—particularly the leg, and give definiteness and precision to these motions, he was placed in a position facing a door-post (the door being open), with the body and thigh of the affected side in close contact with this fixture, and held steadily there; thus situated, he could not flex the leg on the thigh, which was slowly done by another, while the patient co-operating, endeavored to raise the foot from the floor by bending the knee. In this way he soon acquired the power of raising the limb by his own efforts, so long as he remained in this situation; but the moment he left the fixture, the thigh would be flexed on the pelvis, whenever he attempted to bend the knee. The expedient of fixing a strip of cloth to the leg of his pants low down, or of putting a bandage about the ankle with a loop in the free part, held in the well hand, enabled him to substitute it for that of another; but as it was desirable to direct and fix the will of the patient as much as possible upon the muscles and movements of the diseased limb, and as this plan seemed to divert his attention therefrom, it was relinquished, and in the course of a few weeks he acquired such power over the former as to raise the foot, to kick with force, and even run.

To enable him to flex and extend the foot, was a more difficult task; for the accomplishment of which, he was placed in a chair, and the foot flexed and extended at the ankle by another, he at the same time using his best endeavors to assist. The improvement here was in a short time quite apparent, but less rapid than in the motion of the leg on the thigh. After a while the experiment of standing upright on the affected leg only was tried; and by steadying

while those of the arms and hands are allowed to remain unexcited and idle. The early training of the upper extremities would cause them to improve, *pari passu* with their congeners.

himself with a hand on the back of a chair, he succeeded tolerably well in this difficult undertaking, and was not long in acquiring the power of not only sustaining himself, but of maintaining his equilibrium on this limb alone. In the progress of improvement the paralytic habit of walking almost entirely disappeared—especially if he walked slowly, and took short steps, as he was instructed to do. To exchange this awkward gait for one more natural and comely, was mainly accomplished by setting the lame foot flatly and firmly on the floor or ground, and taking care not to move the other until the weight of the body was transferred to the affected limb, when the well foot was to be raised, carried forward and planted steadfastly on the ground. This done, the lame limb and foot were put in requisition to push the body forward upon the well member. At first he was obliged to take very short steps, but soon acquired the habit and ability to take steps about the usual length, and to walk so well that few would suspect that any thing ailed him. Besides, he even became at length able to run with considerable facility and smartness.

In disciplining the superior extremity much difficulty was experienced, principally from three causes—the weakness and inefficiency of some muscles, the rigidly contracted state of others, and the abnormal action of a third class. Those obstinately contracted—mostly flexors—were fully elongated by main strength, and their recontraction obviated and prevented by the application of splints, which not only resisted the contraction, but kept them completely elongated.\* These splints were removed from time to time, and the limbs exercised in the manner described. In case the muscles thus kept on the stretch became painful, the splints were laid aside until the muscles became easy; and as they prevented sleep, they were allowed to remain off during the night, which it was thought somewhat impeded the cure,

\* The contracted state of the fingers was very successfully treated by means of the glove and pieces of whalebone, as will be hereafter described.

both in regard to the restoration of strength to the enfeebled muscles, and the counteraction of those which were unduly contracted. The irregular contraction of the muscles was likewise resisted, in some instances, by splints, and in others, by bands so applied as to prevent abnormal action. It was found that when the action of some of these muscles had been successfully resisted for a short time only, they gave up the contest, and became submissive.

We have stated that the muscles arising from the trunk and inserted into the limbs, had acquired, or seemed to have retained more mobility than others not connected with the trunk; and in the course of treatment, these very muscles were found to be the most mischievous and troublesome of all, particularly those of the upper extremity; for whenever an attempt was made to raise the hand to the head, instead of permitting the biceps flexor to act with freedom in its own appropriate way, the deltoid would assume the right of acting, and raise the arm from the side and move it in all directions so far as its own organization would allow; and other muscles connected with the scapula would also join in the melee, and like the deltoid, move the limb in various ways, but always in opposition to the will. This game was effectually stopped by fastening the arm with a long bandage, closely and almost immovably to the side, and then having the forearm moved at first by another, and then by the patient himself; in this manner the control of the will was acquired and established, so that the limb would be flexed, extended, and indeed moved in almost any direction and to almost any extent, by his own volitions. The head also was moved to the right and left; farther and farther from day to day, and likewise backward and forward, until the power of the muscles by which these movements were effected seemed to be quite recovered. The muscles of the face were in like manner exercised, by which its symmetry was almost entirely restored. He could laugh and blow about as well as ever, and would doubtless have completely



recovered had he been more favorably situated.\* As it was, during the short time he was under treatment, strictly speaking, a few weeks only, he became able to pick up a pin on the table or floor; to button his shirt bosom and vest; to split kindling wood with a hatchet; and do other small matters of business. When he had so far convalesced as to assay the use of the hatchet, he would often try eight or ten times before he could strike a piece of kindling wood two inches square; but in less than a month he would, sometimes for days together, hit a piece one-fourth that size, at almost every attempt, and at others only after several. When he began to use this tool he was instructed to raise it as high as he could well do, and then bring it down *very slowly* upon a designated part of the stick, which he was directed to mark, and fix his eye upon. Having acquired the control of the muscles, he was desired to discharge the blow at first with only a slight degree of force, which was to be increased, according to circumstances, until he could deliver it with tolerable accuracy as well as efficiency—so much so that for two or three weeks before he ceased coming to my office, he amused himself by reducing the pieces of kindling wood to a more convenient size, and was not a little proud of his achievements in that way. Having never learned to

\* Owing to the pulmonary disease and the slight probability of recovery, the friends of this unfortunate young man thought it hardly worth while to make further attempts to cure the paralysis. As this appeared to be a somewhat rational conclusion, in which the patient also concurred, the treatment was discontinued. About three months ago he called on me, looking much better than when I last saw him. Having so long neglected the treatment for paralysis, he had lost much of what he had previously gained, but was, nevertheless, much better in this respect than when he first presented himself to me in October 1856. Expressing a desire to come again under treatment, the same system was resumed. Through the kind-heartedness of Mr. Montgomery, the benevolent superintendent of the gymnasium in Crosby street, he has been permitted to visit, free of expense, that institution as often as he pleases; and has done so almost daily, and in consequence improved very rapidly—particularly in regard to strength and muscular development. Mr. Montgomery and the young gentlemen attending at this important and well managed establishment, have taken great interest in this case, and have never failed to encourage the poor fellow, and assist him in all his endeavors, by instruction and otherwise.

write, he took a few lessons with the pencil, and succeeded, beyond expectation, in making straight marks, O, D, &c.

In regard to this part of the treatment—the training of the muscles—we deem it important, in order to gain the confidence of the patient as well as for other reasons, to begin, as has been suggested, with the simplest motions—as flexion and extension of the arm for instance, and continue their repetition, still urging him to co-operate in each movement, when he will unconsciously make the motions almost entirely without our help, which should be withheld by degrees, and as imperceptibly as possible. When apparent to the assistant that this can be done without aid, or with very little, the attention of the patient should be called to the fact; the truth of which may be so demonstrated as to remove all doubts in regard to his ability. When this is done, the cure may be considered as half accomplished.

While these trials are being made, the patient must be continually admonished to move the limbs at first slowly, and always with reference to accuracy, but regardless of force. When, for example, he can flex the forearm to an acute angle with the arm, and extend it to a line with it, he may be instructed to do so with increasing agility and potency—the one or the other or both augmented and regulated according to circumstances. In the re-education of all the muscles, this plan should be pursued.

This system of treatment can be carried out to perfection in hospitals and in families only in which full and proper assistance and suitable appliances can be commanded and applied. For the hands of an assistant, pullies, treadles, and perhaps other mechanical contrivances, may be substituted, and the patient instructed to carry on the required motions by the efforts of his own unparalyzed limbs. This may be found difficult if not impracticable at first, not exactly on account of an actual indisposition or want of desire on the part of the patient, but because of the absence of positive will, which must be recreated and reconciled with the muscles. Settled in the conviction that matters cannot

be helped, the paralytic is apt to become satisfied with his condition, and is with difficulty induced to make an effort to change it even for the better. This indifference must and will, with due perseverance, be overcome; and as soon as he perceives any amendment, he will enter with alacrity and zeal into the plan and practice.

CASE II.—Thomas Kennedy, born in Ireland, twenty-six years of age, and a painter by profession, was admitted to the New York hospital Aug. 4th, 1856.

Nearly a year before admission he had been seized with intermittent fever of a tertian type, and suffered from relapses of this disease through the entire winter.

About three weeks before admission, while using white lead, he observed the first symptoms of his present disorder; still however having chills occasionally, and greatly debilitated by the malarious disease. His fingers became numb, principally on the posterior side, as did also his toes, on the upper side; and this feeling increased until he completely lost the use of them.

The advance of the disease cannot be very clearly traced. He says that he has never suffered from colic, nor does he know that any of his relatives were ever afflicted with it, though most of them are painters. The paralysis has gradually gained upon him, so that he has fallen into his present condition, and now has the dropped wrists characteristic of lead poisoning. His fingers are curved inward, so as to rest on the palm of the hand, and are so entirely useless that he is unable to feed himself. His toes are bent downward in a curious manner, the end of the toe nail resting on the ground. The muscles of the arms and legs are very much atrophied, especially those of the forearm, the ball of the thumb, and the calf of the leg.

He suffers considerably from pains of a burning character in his arms, the palms of his hands, his legs, and the soles of his feet.



He can move his arms and legs, but is unable to use his hands, or to take a single step. The nurse feeds him, &c. and lifts him in and out of bed.

In this condition, so far as paralysis is concerned, he continued until the 23d of April.

The foregoing, furnished by Dr. Anderson, the intelligent house physician, is an extract from the hospital records. To this young gentleman, as well as to several other *attachés* in the same capacity, I am much indebted for their politeness and hearty co-operation.

The judicious treatment to which this patient has been subjected since his admission into the hospital, has probably caused the elimination of every particle of lead from his system, and also removed the primary and long continued malarious influence beneath which, for a time, it succumbed. The case, therefore, presents principally the secondary and ultimate consequences of those poisons: From their conjoined influence, certain muscles in his limbs remaining long paralytically inactive, have not resisted the "passive contraction" of others; hence the great stiffness amounting to rigidity, with which these last are affected, and which nothing but considerable extraneous force can overcome; while the former, from long continued inactivity, have contracted the habit of inaction. This being the pathological condition of parts so far as the paralysis is concerned, two indications of cure are in the main, to be pursued:

1. To elongate and keep extended those muscles which are over-contracted.

2. To excite and bring under the control of the will those muscles which were in the first instance paralyzed, but are now inactive chiefly from habit. The other indications, as previously laid down in this paper, being less called for by the peculiar circumstances of the case, were not so particularly regarded in its treatment.

"The dropped wrist characteristic of lead poisoning" is

not now as manifest as at first; and a change has likewise taken place in the condition of the fingers. The second and third phalanges are very strongly flexed by the action of the long flexors, (*profundus* and *sublimis*) of the fingers, while the first phalanx of each finger is almost as firmly drawn backward by the *lumbricales*, which being connected with the tendons of the *sublimis* and also with the aponeurotic expansion of the extensor tendons, act as extensors of the fingers, when the flexor *sublimis* is much contracted, and the fingers carried back of a line ranging with that of the metacarpal bones. Neither pronators nor supinators seem to have been much affected.

The state of the muscles, condition of the limbs and general appearance do not seem to be much different from what they were at the time of his admission. The treatment now (April 23, 1857) inaugurated was in accordance with the indications stated :

1. To overcome the resistance of the over contracted muscles, which was done as fast as the painful nature of the operation would admit, and retain by means of the glove and whalebone in the fingers, what had been acquired by force; and also by splints, &c. to the limbs.

May 12.—These agencies, the glove and pieces of whalebone, having accomplished about all that was to be expected from them, were laid aside, and gentle, passive motion (see Indication 2) impressed upon the limbs, was resorted to, the patient himself being enjoined to co-operate and of himself to make frequent efforts to move one limb or parts of it, by acting on it with the other. Besides these manipulations, he was several times a day lifted by two persons out of his chair, and placed on his feet.

In this attitude (his body and inferior extremities forming an angle of  $180^{\circ}$ ) he was each time held a few moments only on account of the pain occasioned by it; but the distress diminished with each repetition. In a few days, by putting his hand on the arms of his chair, he raised himself

further and further from its seat, and soon succeeded in getting entirely out of it, with little or no help; and holding on by his bed, hitched himself along its side from head to foot. He was then placed fully on his feet, and made to stand a few moments between two persons, holding on to them, and held up by them to prevent falling. In this situation he was compelled to bear more or less weight on his feet, or rather on the toes and plantar regions next them, because the gastrocnemii muscles, though atrophied and flabby to the feel when not in action, became exceedingly tense when put upon the stretch; and, contracting with all their force, drew up the heels so that in the attempt to stand, the right heel could not be made to touch the floor by three inches, and the left by two or two and a half inches. Thus fixed, he would sustain the whole weight of his body a short time. From standing he began to step and then to walk—first assisted by two persons, then by one, and lastly, alone by the side of the partition wall—then a step or two by himself, relying however upon the guardianship of one or two persons to catch him if in danger of falling. Crutches were tried; but owing to the disabled state of his hands, he could make little or no use of them, and they were accordingly laid aside. He continued to improve rather rapidly under this mode of discipline, and soon assayed to walk alone—and now (May 25) walks, by short distances at a time, all about the ward, and has had but one fall. His gait is far from being easy and graceful; but judging of the future by the past, we are quite sure it will be not only improved, but quite natural.

June 8.—He can walk half the length of the ward without stopping, with his body tolerably erect, and his legs and arms under good command. Indeed, he is trying “to walk the crack,” an experiment which all the paralytics like him have been required to make and persist in, until satisfactorily performed. In this he succeeds in bringing his feet much nearer the mark than was anticipated. He is directed



to walk slowly at each step, and place his foot on the floor with as much precision as possible, on or near the crack. He has been several times laid up from over-doing.

June 23.—Went twice down into the yard from his ward in the second story in the hospital, and up again, without any one to assist him either in descending or ascending the lofty flights of stairs. The obstinately contracted state of his toes, as mentioned in Dr. Anderson's report, and an inverted nail,\* have considerably interfered with his walking, and impeded his progressive improvement.

July 30.—Has continued to improve, and now walks comparatively well, keeping his body almost erect, and with much less of that waving or swagging motion which was so very characteristic of his gait even after he became able to walk about the ward, down stairs, and in the grounds. About this time an erysipelatous inflammation attacked the dorsum of his left foot, which, with the officiousness of one of the patients in cutting away about half the inverted portion of the nail, has prevented nearly all attempts at walking, and has put him back some six or eight weeks. He is now (September 11) beginning a little to resume his walking, which is only occasionally attempted on account of the pain and inconvenience which are excited by such efforts, and which accompany and follow them. These adverse occurrences have proved a matter of stern regret to the patient himself, and no small chagrin to his medical attendants—and to the writer in particular.

CASE III.—Thomas Collins, 42 years of age, 30 years a sailor, of good constitution, and uniformly healthy, received a violent blow on the right side of the head, near the parietal eminence, which stunned him at the time, and indeed rendered him insensible for several hours—the next morning, however, he found himself quite well, and with the excep-

\* The inverted toe nail is being rapidly cured, by the simple method described in the last July number of the N. Y. Journal of Medicine, p. 9.

tion of a wound in the scalp, the consequence of the blow, and an occasional dizziness, which continued for 10 or 12 days, when he was attacked, November 23, 1856, with a severe headache, which commenced at the point where the blow had been inflicted, and spread over the right side of the head, to which it was mostly confined. The occasion of this pain was accompanied with vomiting, which was almost constant, and very distressing. The night following this attack he became quite stupid, and in 48 hours lost his senses—could retain nothing on his stomach and for 8 or 10 days after, although it was tolerably quiet, could take very little food. One morning, on attempting to get out of his berth (for he was on shipboard) he found himself unable to move the limbs on the right side, with no feeling in the right arm, as high up as the shoulder. The right lower extremity, though motionless and powerless, retained its sensibility. The muscles of the trunk were, as is usual in cases of hemiplegia, not affected.\* In about six weeks the feeling in the arm and hand began to return, and somewhat earlier he had so far recovered the use of his leg as to be able to bear some weight on it; and soon to walk a little by holding on by the rails, but could not move his hand at all.

The following extract from the hospital record, made at the time of his admission (February 28, 1857) into that institution, is corroborative of the foregoing statement made by himself.

“On admission, his right arm was found to be almost completely paralysed with respect to motion—sensation was slightly impaired. It was disposed to be colder than the other, and very much smaller. He can walk without much trouble; but on his doing so, there is a perceptible drag of

\* It is important to take this fact into the account when making up a differential diagnosis in relation to the degree of actually existing paralysis, because the patient, in his attempt to move his limbs, often exerts the muscles of the trunk in a manner which apparently gives the members range of movement that does not properly belong to them, and which they are utterly unable to accomplish by their own muscles.

the right foot—such as is usually seen in hemiplegic subjects. Two months previously he had received a blow on the right side of the head.”

His present condition (April 23, 1857) is as follows: He can raise the elbow to within 6 or 8 inches of a level with the shoulder, and flex the forearm to a right angle, or perhaps a little more with the arm, and slightly move the hand and fingers. The latter were much flexed, and rigidly maintained that condition. He can elevate the thigh to an angle of  $180^{\circ}$  with the trunk, but can hold the limb in that position only a minute or two. When he attempts to bend the leg on the thigh, he can scarcely raise the foot so as to separate the toes from the floor, without flexing the thigh on the pelvis. Speech, deglutition and the muscles of the face are not now, nor have they been at all affected from the first.

Much the same course was pursued in this as in the preceding case; and being a stout, healthy man, with a good constitution, hardened by his mode of living, not at all enfeebled by any of its indiscretions, he soon began to mend. In a week he could raise the arm and place the hand on the top and back of his head, and perform various other motions, which, when the treatment began, he could neither do, nor even be persuaded to attempt. On this account the limbs were at first moved by others, he being urged at the time to assist in the performance. His efforts in this respect were not much interfered with, nor resisted by the involuntary action of other muscles, awakened by such exertions—a contingency already noticed in the case of Batty. In a short time he found that he had a will of his own, and could impress its influence upon his limbs. When fully convinced of this, he entered with spirit into the plan; but with all his efforts he could not at first raise a four pound dumb bell from the bed, but at subsequent trials would take it up, and wield it in all directions with much apparent ease. In ten or twelve days he was desired to raise a small stool from one of the beds in the ward, but after making several trials, gave it up as impracticable. He was however



instructed to make frequently repeated attempts during the remainder of that and the succeeding day. The next day the experiment was repeated with but little success, until he was encouraged to make another effort, with the assurance that he would be helped. The attempt was made, with my finger under the seat of the stool for the purpose of assisting, when with very little help from me the stool was raised about an inch from the bed.

Another effort was made under similar circumstances, and although no assistance whatever was rendered, the stool rose to the height of six or eight inches, and in a few days it was taken by the leg or round and wielded with considerable facility and energy. A large, heavy arm chair, which weighed three or four times as much as the stool, was now substituted, but could not be raised from the floor at all. The attempt was repeated with an assurance of help as in the former instance, but with no better success. He was directed to repeat the effort as often as he could, without producing any special inconvenience. The next day it was again repeated, with the same proffered assistance, and the chair was moved, but not raised from the floor. During each succeeding attempt the amount of help was gradually lessened, yet the chair continued to be moved with about the same degree of success, when at length it rose about an inch from the floor. These experiments were repeated from time to time until it was raised some six or eight inches, and held so elevated for a few seconds. He was now informed that the help was only in appearance, and that his late exploits were entirely the result of his own efforts. This greatly encouraged him, and after this discovery he experienced no difficulty in taking up the chair and carrying it half across the ward. The dumb bells were again brought into play—racing, jumping, pulling the rope with his fellow paralytics, assisting the nurse, &c. &c. were resorted to for exercise, and to give strength to the muscles.

In this as in most cases of the kind, the flexor muscles being naturally the strongest, acquired and maintained an

ascendancy, but they were elongated by force, and their recontraction prevented by mechanical appliances. The long splint with the weight was omitted, on account of a suspicion of some disease in the wrist joint, which was not only very stiff, but painful. Pressing the articulating surfaces one against the other considerably aggravated the pain, which did not immediately cease on the removal of the pressure. The muscles of the paralyzed limbs were flaccid, flabby and atrophied, yet when an extending force was applied to the limb, they would become quite tense, and resist with a power which seemed incompatible with their apparently relaxed condition.

As a post-mortem in this case is not to be expected, we may be allowed to speculate a little on the circumstances which seem to characterize its pathology. We infer that the lesion of the brain caused by the blow was superficial, and primarily involved the pia mater and cortical substance of the organ. 1. By irritation and inflammation. 2. By effusion and consequent compression. The vomiting indicated the first, and loss of consciousness and sensation, the second; and the subsequent loss of motion evinced that the compression which resulted from the effusion affected deeper seated parts, as the medullary substance or motory tracts; but to no very considerable depth or degree. Thus far the paralysis is to be considered not the disease itself, but merely a symptom, the final cause or design of which, as a symptom, is identical with that of vomiting; both acting as depletents, were the medicaments of nature: The former prevented the reception of nutritive matter into the system; and the other, by keeping the patient still, prevented the evils which would have resulted from exertion. Every experienced physician knows full well that nausea and vomiting, taken in connection with other symptoms, are indicative of irritation and inflammation of the pia mater, through which the brain receives the blood, by which it is nourished, and its functions sustained. The return of consciousness

and sensation, and also the power of motion, though in part only, showed conclusively that the disease which had occasioned their loss, had ceased; notwithstanding the patient did not move his limbs. Why? He ate, drank and slept well—had little or no pain, and was, to all appearance, quite well. Why then, we repeat, did he not move his limbs? Having abstained for so long a time from the exercise of his will, and the muscles, from contracting the habit of inactivity, had acquired an ascendancy more or less complete over his mind and physical organization. This being the case, all that was necessary in order to effect a cure, was to break up this habit of inaction, which was accomplished in the manner described. The will was revived by putting the limbs in motion, and directing his attention to their movements, and reconnected with the muscles, by urging and indeed insisting upon his co-operation. Very soon he began to give his assistance.

One word more. The direction of the mind to the muscles caused a determination of blood to them; and motion, whether voluntary or impressed by the hand of another, produced the same result—verifying in some degree the experiment of Von Humboldt, who states that “bending the thigh of an animal upon its sciatic nerve induced the muscles to contract.”

It seems to follow as a corollary, that the more frequently muscles contract, and the oftener the mind is directed to them, the more blood will be derived to them, and as a consequence, their nutrition be increased—also their size and power augmented. In this case, the seat of injury and central lesion were on the right side of the head, and contrary to the usual course, the palsy was likewise on the same side.

CASE IV.—Joseph Kanski, a Pole, and gardener by occupation, aged 45 years, was admitted into the New York hospital April 29, with paralysis of the right leg. Five months ago a heavy piece of iron fell upon the top of his head,

which rendered him senseless for a short time. The accident was followed by pain of a throbbing character, which has troubled him ever since. Two months since he experienced a sense of numbness in his right foot and leg, which gradually extended up to the arm of the same side—also that of insects crawling over the leg, with spasmodic twitchings of the muscles. The temperature of the limb was natural.\* Now, on his attempting to walk, dragging the foot is very observable, though he moves about without much trouble. He moves his arm freely in every direction. Sensation in the leg is somewhat blunted—in the arm, not at all. Reflex action is very marked in the leg, the slightest pinch causing it to twitch violently. His bowels are inclined to be constipated, and he has some difficulty in retaining his urine.

The above is the hospital record of this man's case, which, owing to the state of his mind at the time of admission, was all that could then be gathered. His mental faculties having since improved, he now (May 13) gives the following additional particulars: That at the time of the accident he had on his head a thick cap—notwithstanding considerable tumefaction at the place of injury immediately ensued; that he resumed his labors in the garden in the course of two or three hours, and continued from day to day to work as usual; that his sleep was very much broken, and his rest much disturbed; that he felt tired and bad every morning on rising from bed. He says that matters went on much in this way for three or four weeks, except that he seemed to be gradually getting worse, when he began to experience a sense of coldness (usually we believe the earliest premonitory symptom of approaching palsy) and numbness in the right foot, which gradually extended up to the arm and right side of the face. Sometimes he would feel as if all this side of his

\* Had this patient put his limb in motion when he experienced these symptoms, and continued to do so, as he did subsequently, we can scarcely allow ourselves to doubt that the attack which followed would have been prevented.



body was dead. When this sensation, which usually lasted about ten minutes, went off, he would walk round and round in a circle for a few minutes, and then fall, or be thrown to the ground, where he would lie four or five minutes, and then get up and go to work. These turns came on irregularly—sometimes twice a week, and sometimes oftener. He has had none of them or any thing of the kind the last two or three months. Previous to entering the hospital, on attempting to move about from place to place, he was often obliged to run to prevent falling. He has had no difficulty in swallowing, but much in articulating, which is not even now wholly overcome. He urinates ten or twelve times in the 24 hours, and discharges a larger quantity of water than before the accident. He has had all along and has now considerable trouble in his head, as pain and dizziness, with but little exact control over his right leg—indeed both legs appear to be somewhat affected. His gait is very unsteady—so much so, that one of the patients in the ward said, “he walks like a drunken man.”

*Treatment.*—He was managed much in the usual way, by being placed sometimes with his back and sometimes his face against the side of the room, or in one position or another, had his limbs, particularly those of the right side, moved in various directions, he being exhorted to co-operate, &c. &c. He was then set to walking—very slowly, but with all the exactness and precision in his power. Having practiced in this way until he could use his legs with more certainty, he was required “to walk the crack,” which was at first done awkwardly enough, but encouraged to persevere, and assisted by his companions, who had a better use of their legs, he soon began to improve, and continued to do so very rapidly, and in a few days performed in a manner very much to his own satisfaction. He can also stand a minute or two, with considerable steadiness on the afflicted foot, while the other is raised from the floor—a very difficult task for these patients to accomplish.

May 18.—This man, although he has improved very much

so far as the paralysis is concerned, has a good deal of trouble in his head, for which a blister to the nape of the neck was prescribed by Dr. Griscom.

May 21.—Head considerably relieved. He now walks tolerably well, but is evidently quite weak. Suspicion of some indefinable trouble in the brain—ramollisment perhaps—has been entertained, and it was therefore deemed not prudent or expedient to push the treatment but moderately, lest his nervous energies should be over-taxed and exhausted.

May 25.—He is about the same as on the 18th. The nurse was directed to make arrangements for ascertaining the exact quantity of urine discharged, and the intelligent young gentlemen in attendance, to have it examined chemically and microscopically. I am not aware that this was ever effectually done.

This man continued to improve, so far as the paralysis was concerned, but slowly it is true, for the reason above assigned. During his convalescence he had frequent slight attacks of threatened paralysis, almost losing the use of his right arm or leg. Both were never affected at the same time. He was instructed to put the limb, whichever it was that was assailed, in motion, and keep it moving whenever he perceived the sense of numbness, &c. affecting it in the slightest degree, as the surest method of preventing a recurrence of the affection; and this he found invariably successful. For the difficulty in the head the medical gentlemen, Drs. Griscom and Smith, prescribed various remedies, by which he was somewhat relieved. Dr. Bulkley, when he came into service, put him upon a course of mercury, which lightly salivated and perfectly relieved him of the cerebral affection. He remained in the hospital up to the 21st of July, when he was discharged “cured.” Notwithstanding, it was a matter of regret both to Dr. Bulkley and myself, that he was not retained in the house a few weeks longer, lest a relapse should occur.

*Hospital Record of Robinson's Case.*

CASE V.—“James Robinson, aged 25, Vt. seaman, admitted May 28th. One year ago, while standing at the helm, he suddenly felt a sensation in his right foot, as if it were asleep, which soon extended to the arm, and in about fifteen minutes he found that he had lost all power over the limbs of that side.

He says the sun was very hot at the time, and shone directly upon that side of his body. He had no pain nor blindness then nor afterwards, nor was his power of speech affected. His general health was good.

For a week after the attack he was able to move about but little; after that time he began to improve.

At present he is able to walk tolerably well, but his control over the right leg is impaired. He moves his arm without difficulty, but complains of its weakness. It is tremulous when he extends it.

Bowels regular; appetite good; skin natural; renal secretion abundant.”

*Additional Particulars concerning the Attack.*

In a week after the attack he was able, as stated in the hospital record, to get out of his cot and walk about, and near the same time the feeling in his leg returned; and on the 15th of June feeling came into his hand and arm. In a month or two—he does not exactly recollect the precise time—he began to have the power of motion, which commenced in his right thumb; and in two or three weeks after, he could move the arm, *first in the shoulder*, and in a week or two after this could flex the forearm at the elbow, but could not extend it. In three weeks more he could move the fingers.

It is true that he now (June 1) walks tolerably well, and moves his right arm without much apparent difficulty; yet

it is obvious that these movements depend considerably on the motions of the body, particularly at their commencement ; and they are likewise much influenced in their progress by the same agency, for when the trunk is confined, the motion of the limbs is constrained and restricted in no small degree. The right side of his face was and is now somewhat affected—also the right eye—so much so that he cannot read with it. The pupil is contracted and scarcely movable, and through it a slight haziness is perceptible. Motes are all the while present, and a spectrum resembling a half moon, constantly occupies a part of its field of vision on the sight. The tongue when protruded, inclines slightly to the affected side. The attack was at noonday, in a tropical climate (the Gulf of Mexico), under a hot sun, whose fierce rays fell, as stated above, with unbroken violence upon the affected side, which, from his position at the tiller, was most exposed.

Want of precision and power of motion constitute the principal characteristics of this case.

This man had previously been affected with syphilis, but at this time seems to be free from its contamination. Was this exposure to the intense heat and light of a burning tropical sun the exciting cause of the paralysis—particularly of the affection of the eye? The central brain proper does not appear to have been affected. Was it then the peripheral brain only?

Owing to the fact that, during the whole or most of his indisposition, he had been able to move his limbs ; there was less muscular atrophy and rigidity than there would otherwise have been if motion had been suspended or much impaired. From all the circumstances of this case we inferred that the principal difficulty was located in the peripheral brain, to which allusion has been repeatedly made.

*Treatment.*—The usual course of training, as described in the other cases, was adopted and pursued ; under which he improved for a time in a very satisfactory manner ; but having reached a certain point he became quite indifferent about



making further effort or progress,\* and was, at his own request, discharged on the 29th of August, considerably improved.

CASE VI.—David Lynch, Irishman, aged 25 years, occupation that of a farmer, experienced, in October 1856 a sense of weakness in the toes, more particularly the great toe of the left foot, which extended up the leg, and by the 1st of January following, affected the whole limb. In the course of this and the succeeding month, his legs—indeed all his limbs, arms as well as legs—became affected in much the same way. The sense of weakness in the upper extremities was first felt at the inner side of each forearm just above the wrist, from which it extended upwards, and occupied the whole of both limbs, although for a while it seemed to take possession of the biceps flexor muscle in each arm, where it paused and remained stationary for a short time, but soon began to spread in all directions over both arms. Of the two, the right was most affected. From the first, and through the whole progress of the complaint, there has been no diminution of feeling. All the functions of organic life have been normally performed, and he has been in perfect health, with the exception of a sense of general weakness, and an inability to move his limbs voluntarily.

The foregoing is the account of the case, as gathered from the patient himself, and his general appearance certainly confirms the latter part of the statement. His hands and wrists are large, not swollen, and appear as if they constituted parts of a powerful frame. His face is round, plump and ruddy. The muscles of expression, deglutition, articulation, respiration, and of the tongue, are all *intact*. The functions of

\* This trait exhibited by Robinson is not uncommon with paralytics. Satisfied with having recovered to a certain extent, they are apt to decline further effort. They are well enough to carry on their business or enjoy life, and perhaps too lazy to endeavor to attain more ability. Why, then, they reason, should they give themselves any further trouble?

the rectum and bladder are undisturbed. The movements of the head are in all directions perfect, and entirely under the control of the will. He can elevate or shrug the shoulders with unabated force. The intellectual faculties are unaffected.

The voluntary muscles seem to be the only organs out of order; and they from derangement or mere weakness of function. To the eye of the ordinary observer he appears, while at rest, in good health, but when in motion the feebleness of which he complains is manifest. When stripped the muscular atrophy which prevails, particularly in the limbs, is quite obvious. In the trunk it is less apparent. The muscles about the scapulae and along the arm, even below the elbow, are much emaciated, while the hands, wrists and forearms, for two-thirds their length, are less affected. The muscles of the lower extremities are not as much atrophied as those of the upper, which is imputed to the fact that they had been more exercised by walking about, which, as he would do nothing else, he did as much as he was able. The muscles of the trunk, which he avers have fallen away, have to appearance held their own better than those of the extremities; and those which arise from the trunk and extend to the limbs, have suffered more than those which pertain exclusively to the body.

When he entered the hospital, he says he was so weak that he could scarcely get up into the ward without help, and only by pulling himself up by the balusters. Although he can walk about and move his arms, yet every motion is performed in an awkward manner. His limbs, particularly the arms, are moved mainly by impulses communicated to them by the trunk, and not by their own muscles—consequently very little in accordance with the will—but seemingly as they listed. When desired to bend the arms at the elbows, he declared, most pertinaciously, that he could not—that it was impossible; and when it was insisted that he should make the effort to do so, almost every muscle connected with the trunk and arms was brought into irregular

action, as were those also which belonged exclusively to the body; for he tried with his might, but the forearm and hand would not come up. If moved at all, they would be moved in almost any other direction than the one intended.

The case was certainly anomalous. It would hardly be considered as one of pure paralysis, according to the strictly scientific meaning of the term. Is it an affliction of the brain? There is no dizziness—no vertigo—while the senses of sight, hearing and smell are intact. The inference is certainly against it. Is it a disease of the spinal marrow—softening or fatty degeneration of it, or of the muscles themselves? Was there a wasting of the anterior roots of the spinal nerves? Or was that portion of the peripheral brain located in the voluntary muscles mainly affected? To this opinion, the writer, considering the case somewhat analogous to that of the widow reported by Dr. Klaatsch,\* is rather inclined. In her case the peripheral brain, in its sentient parts, was the seat of the affection. In this of

\*“Dr. Klaatsch relates the case of a widow, aged 58, who applied to him, on account of severe pains in the extremities, and a powerless state of the upper ones, which prevented her from grasping any object firmly. She also complained of an irrelievable sense of hunger. In other respects, with the exception of occasional headaches, she was quite well; had had nine children, still menstruated moderately, and exhibited no symptoms of hysteria. An examination exhibited no appearance of paralysis, but the sense of feeling was lost over the entire skin and orifices of the mucous membranes, and could not be excited by pricking with needles. No unpleasant feeling was excited by irritating the nares, the conjunctivæ, or the mucous membrane of the mouth, and the fumes of ammonia produced no effect upon the respiratory organs. Boiling water and a prolonged application of the electrical pencil alone induced some feeling on the surface. The sense of contact was retained, and she was enabled to exactly indicate the spots at which she had been pricked. The power of distinguishing between differences of temperature was abolished, but the muscular sense remained, as she was conscious of the position of her limbs, and could determine the weight and size of a body, by grasping it. The senses of smell and taste were lost, and both hearing and vision were somewhat defective, although she had not before observed diminution in their power. The reflex excitability was very slight, the rapid application of hot sponges exciting but slight movements. Tickling of the fauces did not induce any disposition to vomit. This patient was restored by electricity. There were no symptoms of hysteria.”—*Medical Times and Gazette*, June 30, 1857, from *Deutsche Klinik*, No. 45. Republished in the *Med. News*, August 1857.

Lynch, it is the peripheral brain pertaining to the muscles of animal life. No definite opinions were, we believe, formed by the medical faculty attached to the institution at the time of his admission—at least we heard none expressed.

### *Peripheral Brain.*

The neurilemma is the fibrous sheath which invests the nerve cords from their exit or passage through the bony casement which includes the cerebro-spinal axis—the central brain, to their termination in the ultimate fibres. The design and use of this investing membrane is to secure the nerve cord from being acted on by the parts through which it passes, and to prevent them from being acted on by it in its transit. The nerve fibres, at their origin in the brain and spinal marrow, and also at their distal termination, are uninvested.\* At this extremity the ultimate fibres and the branches or primitive fibres into which they break up, mingle with the substances by which they are surrounded, and with which they are in immediate contact. These unneurilemmated termini, ramific or motific, according to the nerves of which they form a part, constitute what we mean by the peripheral brain, which in many instances manifests itself quite independently of its congener, the central brain. For example: The heart of a frog, some minutes after exsection, is made to palpitate, by pricking it with a needle—thus furnishing undeniable proof that the portion of nerves, intermingled with its fibres, possesses the power of feeling and

\* Every nerve fibre, in its course, proceeds uninterruptedly from its origin at a nervous centre to its destination, whether this be at the periphery of the body, in a nervous centre, or in the same centre whence it issued. In the whole of its course, also, however long, there is no branching, or anastomosis or union with the substance of any other fibres." \* \* \* \*

"Hence the central extremity of each fibre is connected with the peripheral extremity of a single nervous fibre only; and this peripheral extremity is in direct relation with only one point of the brain, spinal cord, or nervous centre: so that, corresponding to the many millions of primitive fibres which are distributed to peripheral parts of the body, there are the same number of peripheral parts of the body represented in the nervous centres."—Paget's Manual of Physiology, p. 279, 280.



also of motion. Perception is the function performed at the extremity of the nerve, by the peripheral brain. The change there produced is communicated, telegraphically if you please, to the central brain, by which a change is there effected, that is productive of thought. The first change is modified by the physical or other properties peculiar to the cause; which modification is likewise communicated to the brain proper, in which a correspondent modification of change is produced; in consequence of which, an idea of the character and nature of the cause is induced. When these operations have been performed a number of times, the individual acquires the power of reproducing, by a voluntary effort, the identical change in the cerebrum, which is followed by the same change as formerly in the peripheral brain; and thus, by an effort of the will, he can re-excite the idea of the agent which originally caused the aforesaid operations, &c. whether they be sensitive or motive.

The prevailing sentiment was in favor of the course of treatment which had been so successful in the other cases, and the following process was adopted. He was placed with his back against the wall, and held steadily there. Each hand was taken in one of mine, and he admonished to stand in the most careless manner, and make no effort of his own—none at all—but leave the matter entirely to my management: He was only to observe attentively the procedure. His hands were now brought a little forward by flexing the elbows; but even this *per se* was found to be impracticable, because almost every muscle would as before mentioned, be called into action. To prevent this, the arms were confined at the elbows and the shoulders, and upper part of the trunk, by assistants. Under these restraints the elbows were flexed—a very little only, while he was assured, in the most careless manner possible, that a slight degree of motion only was all that was wanted, and that we did not care about his rendering any assistance whatever—that all we desired of him was merely to permit the movements to be made. The object of this was to have his attention, inadvertently as it

were, directed to these motions, which were being thus effected, without exciting others which were undesired to accomplish certain co-ordinate actions without calling into play certain others, which were any thing but co-ordinate. In the course of half an hour thus spent, this point was in a measure gained, when it was remarked, in the same careless manner, that he might assist a very little if he pleased, and his attention was by the application of his hand, directed to the movements of the biceps flexor muscle in my arm, which took place when my hand was being raised—from mine to this part in his own arm his hand was transferred, and he was desired to note whether he could perceive any movement there when his hand was raised, and he was not long in discovering the fact that motion was likewise there. This was probably the first time in his life that he had been fully conscious that here was lodged the agent by which the hands were raised. After this discovery he was desired to make that action a little more effectual, and soon found that by fixing his mind on that part, and willing to have the hand ascend, it would rise a little distance only, to be sure. He was now desired to think the matter over, and occasionally endeavor to make this single muscle contract without calling any others into action, and he was not long in acquiring some influence over it and nearly all the muscles of his limbs. This influence was very feeble, and at times seemed to be almost entirely dependent on the movements of the trunk. Walking very slowly and carefully was enjoined. He was desired every time he put his foot down to mark the spot where the tread was to fall, and soon was called on “to walk the crack,” which was at first done very awkwardly, but in a short time his improvement was quite evident. From walking—running, jumping, hopping, balancing the broom, brush end up, &c. &c. were assayed, but rather indifferently performed. To these the india rubber foot, and small hand ball were added; also, the rubber parlor ball suspended at different heights by a cord, was displayed, at which he was to strike with the open hands as often as it

swung near him. When fatigued, these exercises or amusements in which the other paralytics and inmates of the ward joined, were to be suspended. Being an Irishman, he took much pleasure in fisticuffing a pillow which was from time to time held up for the purpose. His improvement was very slow, and at times, especially if he over-acted, was suspended or entirely interrupted for two or three weeks at a time. He was particularly delighted with the exercise of striking the suspended parlor ball, and over-did the matter, and has not only not advanced, but has actually retrograded so far as power is concerned; but he has now, September 9, more definite control over his forearms and hands than I have before witnessed. He indeed raised the hands nearly to a level, and almost in contact with his shoulders with but very little (almost none) of the accompanying action of other muscles, which had hitherto been so officious.

*Hospital Record of the Case of Andrew Lottimer.*

CASE VII.—Andrew Lottimer, admitted May 20. While lying in bed on Sunday morning playing with his children, he suddenly became insensible. After he came to himself, his wife told him that he had been insensible for two hours—that he had foamed at the mouth. When he recovered his senses, his left hand felt larger than natural, and gave him the impression that it was another person's hand. On attempting to move it, he found it paralyzed. His tongue protrudes to the left, and is slightly coated. The left hand is completely paralyzed, but sensation is restored. He is able to move the leg of that side, but says that it gives way when he attempts to walk. His pupils are unaffected; skin natural; pulse 54; bowels constipated; person corpulent. He is in the habit of using spirituous liquors. Had drunk some on Saturday. Ordered cathartic treatment.

July 29.—Is able to walk, but halts considerably. Can balance himself for a moment on the paralyzed leg. His

left shoulder hangs lower than the other. He can nearly close the hand and raise the arm to a level with the shoulder. Extends the hand and fingers with some difficulty, but says he can use it much better in the morning than at night. Tongue protruded to the affected side. Speech somewhat thick. Put under Dr. Batchelder's care for gymnastic exercise.

August 29.—Has sufficient use of his hand to go to work, though it is not as strong as the other. The shoulder still drops some. Halts some on the left leg. Cured."

We have gleaned the following additional particulars from the patient himself. For six months previous to the attack, his left leg had been somewhat affected with cramps when in bed, which went off almost immediately on getting up and walking about. A while after the attack he began to experience a sensation of increased warmth, (the earliest sign of improvement, according to our observation and experience), in the affected foot, but no change of feeling was perceived in the hand or arm. Not long after this, he commenced *trying to move the toes, and then the foot, and soon succeeded in both attempts*, but in a moderate degree. He was taken out of bed, and placed in a chair by others, in which he remained until the bed was made, and then replaced in it in the same manner. Subsequently, when taken out of bed, he was raised and placed on his feet, on which he was allowed to bear some weight, when the nurse said to him one day, that "he must try to walk, by taking hold of things," &c. To this he replied, "that he was going to walk on the 4th of July, which was only two or three days ahead." Although nobody believed him, his own mind during the interim was very much occupied and exercised with the idea of doing what he had announced that he would do on that day, and he was as good as his word. He got up, or rather was gotten up, placed on his feet, and walked the whole length of the ward without help, and continued to walk about more or less every day, and to improve slightly in this mode of exercise. Up to this time (July 29) the improvement in the upper extremity had been much slower.



The course of treatment was much the same as in the other cases, which have been given in detail. He was placed against the wall—sometimes with the face and sometimes the back in contact with it, and his limbs moved, &c. The long splint and weight were applied to the arm, and removed several times in the day—with other and various kinds of exercise, appliances and devices for bringing the muscles into various and gentle modes of action. Although he could walk, to stand and maintain a standing on the affected limb alone, was a very difficult attainment, and at first impossible, but was ere long accomplished. After considerable training, by short steps, long steps, pacing the ward in its length, but very slowly, the india rubber foot ball was introduced, and the patient directed to kick it with either foot wherever he could find it. In this exercise other inmates of the ward besides the paralytics joined with great gusto, and it was not long in coming to be a favorite exercise with all who could join in the sport, and a matter of infinite amusement to those who from infirmity could not take a part. The paralytic patients were, however, directed to quit the fun as soon as they began to feel the slightest fatigue.

This man continued to improve up to the 29th of August, when he was discharged “cured,” as stated in the hospital report.

September 3—He called on me at my office this morning, having walked all the way from home, several miles. He looks well, and says he shall go to work next Monday. He was cautioned to be very exceedingly careful not to over-do.

*Partial Paralysis—(Written by Dr. Dubois.)*

CASE VIII.—Abner H. Clyde, aged 25, N. Hampshire, seaman, admitted February 16, 1857, (Dr. Van Buren,) with slight frost-bites on ends of four fingers of right hand and the three middle ones of left, which he first noticed two weeks ago, and probably caused by pulling in ropes at sea which were covered with ice. The skin only is involved, of

a pale tallowy color, hard and insensible. He has also paralysis of extensor muscles of left wrist and hand, causing dropping of that hand exactly similar to that caused by poisoning by lead. He has not been exposed to contamination by lead in any way, that can be ascertained. He says that 8 days ago he got into a fight on shore, and was struck on the left side of head with a piece of rope, and also across the loins. He was stunned and knocked down by the blow, but soon recovered consciousness. Four days after, he first noticed this dropping of left hand. There is partial paralysis also of the flexors of the hand and wrist, and also of the flexors of elbow.

*Treatment.*—Ends of fingers painted with tr. iodine.

February 22.—Ordered sol. iod. pot.  $\bar{5}$ ss. ter in die. Dead skin has been removed from ends of fingers.

March 1.—Not much improvement. C. T. Fingers about well.

March 10.—He can now bend his elbow without much difficulty, and when his hand is held back pretty strongly. Dropping of wrist continues the same.

March 19.—Not much change in the paralysis. Takes now sol. iod. pot. ter in die.

March 30.—Can now grasp with more force. C. T.

April 18.—Takes iod. pot. grs. xv, ter in die, and general stimulants. Thinks he is gaining slightly in power over his fingers. He cannot move his wrist.

April 21.—Ordered T. nucis vomii, gtt. xl, aq.  $\bar{5}$ iv,  $\bar{5}$ ss. ter in die. Stop iod. pot.

May 11.—Since April 25, patient has taken T. N. vomii,  $\bar{5}$ i, aq.  $\bar{5}$ iv,  $\bar{5}$ ss. ter in die, and says that he gains slowly some power over his fingers. He cannot raise his wrist, but can grasp with his hand pretty firmly. Patient placed under Dr. Batchelder.

June 2.—Patient has rapidly regained the use of his fingers and wrist under Dr. B.'s treatment.

May 11.—As stated above, this patient came under treatment. In my minutes it is stated that the left hand is

dropped, and the fingers obstinately flexed, as in lead palsy. No effort of his can raise the former or straighten the latter. In his attempts to do so, various muscles in other parts of the body, particularly in the opposite leg, near and about the ankle and foot, are called into vigorous action. The movable splint was applied as in the other cases, which he was instructed to keep in motion as much as possible, and to have it removed from time to time, to exercise the hand and fingers as well when it was off as when in place. The glove and whalebone strips were also applied. In less than 48 hours, signs of improvement became apparent, and in 3 or 4 days he could raise the hand to a level with or in a line with the forearm, and also considerably extend the fingers, and separate them one from the other, about half an inch at the ends. When raised, the hand could be maintained a few seconds in that position. The power of motion continued to increase until, at the end of two weeks, he began to talk of leaving the hospital, and on the 2d of June was, with the consent of Dr. Griscom, discharged "cured." Since which, he has not been heard from.

In this case, smart percussion on the cervical vertebrae over the origin of the nerves which go to the arms, or sudden and even violent twisting of these parts gave no pain or uneasiness. Therefore, the inference was that neither the bones nor ligaments nor intervertebral cartilages were affected. The sense of feeling was not affected. The disease could not, it was thought, be attributed to the blow on the head, as no symptoms indicated trouble in the brain, nor indeed any which complicated the spinal marrow. Exposure to cold was the probable cause of the loss of motion. The seat of the affection is not in the central, but peripheral brain—that portion of it pertaining to the muscles whose functions failed.

CASE IX.—"Martin Quigley, New York, seaman, was admitted into the New York Hospital April 18. Patient comes in with partial paralysis of the left hand. His wrist

has the peculiar drop, characteristic of saturnine disease. He is unable to raise the hand, or to extend it on the wrist, though he can move his arm without any trouble. The fingers curve slightly towards the palm. He ascribes his disease to the fact of his having slept with his head resting on his forearm, after having been engaged all the preceding day in wheeling heavy loads of coal. He lost the use of his hand, he says, from this cause. Otherwise he is strong and healthy."

The foregoing is the hospital record of Quigley's case at the time of admission.

On the 23d instant, five days after admission, the following course of treatment was adopted: a splint was applied to the forearm, reaching from near the elbow to the ends of the fingers, which kept them and the wrist extended in a line with the forearm. As this splint while in place prevented motion, it was laid aside, and another contrivance substituted, which consisted of a kid glove drawn upon the hand; between the digits of which, and the palmar surface of each finger (forcibly straightened) a narrow piece of whalebone six inches long was passed. The thumb was treated in the same way. These whalebone splints kept the fingers completely extended, without interfering in the least with the movements of the hand at the wrist. To bring and keep the origin and insertion of the extensors of the wrist and fingers nearer to each other and enable the muscles to gather strength from the passive contraction already alluded to, and also to bring them under the control of the will, a wooden splint, as before described, was bound rather firmly upon the palmar surface of the hand, by passing a roller two or three times round the fingers, and once or twice round the hand, between the thumb and wrist, in such a manner as not to interfere with the motions of either the hand or wrist. To the upper end of this splint was appended a weight by means of a large wire bent in the form of an S, one end of which was hooked into a hole in the splint, and upon the other was hitched a



weight sufficiently heavy to keep the hand back in a direction approaching a right angle with the forearm. This weight did not prevent the contraction of the flexors when subjected to the influence of the will; the patient was therefore directed, by contracting them, to keep the hand in motion as much as he could well do. The moment the flexors ceased to contract, the weight at the end of the splint would bring the hand back to the position described. The arm was now placed in a sling, which excluded the splint, and the patient desired to allow it to remain resting therein as carelessly as possible. The design of the sling was to prevent fatigue, and more especially to favor the influence of the splint and weight in persistently resisting the excessive action of the flexors, which militated so much against the cure, and likewise to accomplish the objects in view, without exciting other muscles to contract, whose action was not wanted.

Notwithstanding this arrangement, and all our injunctions to the contrary, these muscles would act whenever he attempted to extend the hand and fingers with any decided voluntary effort. In consequence of this condition of things, he was desired to keep the hand in motion, in an easy careless way, so little under the influence of the will as not to bring other muscles into play, and to keep his attention to the movements thus going on, particularly those by which the hand was extended.

May 23.—Discharged “cured.”

CASE X.—Matthew Farrell, 31 years of age, a baker by trade, received on the 27th of last May a heavy blow from an axe on the middle of the left parietal bone, which fractured the skull, and knocked him down. He was unable to speak for some time, and has had trouble in articulating ever since, but is now much improved in this particular. The right arm and leg were rendered motionless, and continued so for a short time. He can now (June 8th) readily move them, with the exception of the right hand and fingers, the

present seat of the paralysis. Flexors and extensors are both affected—the former much less than the latter—consequently the fingers are continually bent and cannot be straightened, or indeed rarely affected by the extensors. The hand also drops, and cannot be raised to a level with the forearm. When he makes a strong effort to raise it, almost all the muscles of volition, not immediately concerned in that effort, take on vigorous abnormal action, while those whose contraction should elevate the hand, are most provokingly quiet.

June 9.—He came under treatment yesterday, and thinks he has improved a little. Spent more than half an hour with him in trying to teach him how to cause the extensors of the wrist and fingers to act, and finally succeeded in getting him to move the hand backward about half an inch. As the supinator longus does not appear in such cases, and especially in the drop hand from lead, to be much affected, the thought occurred that if this muscle could be made to act, the two radial extensors, which are much in the habit of acting with the supinator longus, might be induced to renew their former habit of acting co-ordinately, which was found to be as true in practice as plausible in theory. Profiting by this piece of strategy, and persuading Farrell, when making extension to supinate the hand strongly, it was soon apparent that its extension would be increased an inch or more, without exciting other muscles in the arm or other parts of the body to efforts not called for or desired. Although aware that the supinator longus was generally exempt or not applied in paralysis from lead poisoning, it had never until now occurred that this fact could be turned to account in the education of these muscles.

June 13.—Discharged “cured.”

This man continued to improve very rapidly till the 13th, when he left the hospital. Since which, no information in relation to him has been obtained. I have not been able to

get the hospital record of his precise condition at the time of his leaving that institution.\*

CASE XI.—Thomas McCuen, aged 30, by trade a boiler maker, was, on the 22d of March 1857, thrown from a rail road car with great violence upon the ground—was stunned, and remained in a state of insensibility for a considerable time—he does not know exactly how long—but when consciousness returned, found he could not move the limbs on the right side—they were motionless, but not insensible. In about four weeks he began to move the limbs a little—the legs first, and then the arm. When lifted up and placed on his feet, he could stand alone. In a few days he began to step a little, when supported by two assistants. He can now (May 16, 1857,) walk tolerably well on a level surface, but finds it difficult to raise his feet, particularly the right one, but a few inches only from the floor. During the first week after the accident his water was drawn off; but now he can empty the bladder without the assistance of the surgeon. His bowels are costive, and have not been moved since the accident, except by cathartic medicines. Although he can move the arm in almost any direction, he cannot extend the hand and fingers, neither can he close them, particularly the fingers, but very imperfectly. When thrown from the cars the right side of his body and head came in contact with the ground. On the latter, two wounds were made—one on the middle of the left parietal bone, and the other over the sagittal suture, about midway between the anterior and posterior fontanels.

*Treatment*—Much the same as that practiced in other cases. The glove and whalebone splints, and splint with the weight, were principally employed for the recovery of the hand, with the happiest effects. He came under treatment on the 16th, and was discharged “cured” on the 29th.

\* Not succeeding in getting a report of this man's case from the books of the hospital, the foregoing account of his case was taken from his own lips.

I have not been able to get a copy of the record of this man's case, as it was entered upon the hospital books. The foregoing account of his case was gathered from himself on the 16th of May, and subsequently. I have no doubt of its correctness and accuracy, for he, as well as the others, was cross-examined with a good deal of closeness and care.

#### ADDITIONAL REMARKS.

##### *Time of Attack.*

Paralysis, like apoplexy and epilepsy, not unfrequently attacks during the night, while the patient is in bed, and after sleep. The recumbent posture, and the consequent distention of the cerebral capillaries, and the pressure which they make on the nervous centres (the proximate cause of sleep, we think), seem to favor and invite the attack; and we shall often find, on enquiry, that if the subject be a male, the accession has been preceded by masturbation or a coitus.

##### *Particular Symptoms.*

*Sense of coldness*—taken in connection with other premonitory symptoms, is particularly significant—indicating a tolerably certain and near approach of the disease; and when it begins to abate or be exchanged for a sense of warmth, it presages a favorable termination. Either way, it is a symptom of prognosis—otherwise, it is not particularly important. It seems to be somewhat idiopathic; for it obtains as well when the paralyzed limb is red and tumid as when it is pale and shrunken. In the first instance, when the hand, for example, begins to grow warm, the tumefaction and redness likewise begin to subside, and entirely disappear when the member assumes its natural temperature. In the second instance, when the warmth returns, the limb resumes its natural size and color.

*The sense of numbness* is the most common of all the premonitory symptoms. It is indeed seldom absent, and is



sometimes attended with a sense of fullness, and occasionally with some degree of tumefaction. It generally affects the patient when at rest—warm in bed—towards morning.\* As a premonitory symptom, it primarily affects the peripheral brain, and indicates that the ultimate nerve fibres, in the part where it is experienced, are compressed. This compression is induced in the following manner: The capillary vessels of the part, having from some cause or other become less susceptible to the stimulus (that of distention only, perhaps,) of the fluids which they circulate, do not resist; but yield to the ingressive impulse of those fluids until they (the vessels) become so distended as to compress these termini (ultimate fibres); by which compression this numbness or obtuseness of feeling is occasioned. The remedy is exercise, which transfers the fluids from the sentient papillæ to the muscular tissue, and affords relief as prompt as it is certain. Like other premonitory symptoms, it frequently precedes a storm or falling weather. In this respect an analogy obtains between these symptoms and the pains and aches, of which patients, subject to gout or rheumatism, or who have suffered from severe accidents, are so apt to complain. Under such circumstances, the cutaneous capillaries, and also those of the fibrous structures, unsustained by the pressure of the atmosphere (15 lbs. to the square inch), become preternaturally distended, and complain—the former discovering numbness, the latter, the language of fibrous tissues in trouble. Now, in all these cases, no matter to what cause the pathological changes are owing, they may be speedily removed by exercising the muscles—often for a short time only. Almost every individual affected in this way has frequently found these feelings cease as soon as he got well engaged in the active business of the day. To such patients our advice has invariably been, to put the limbs in motion, and thus have seldom if ever been disappointed in obtaining the desired relief.

\* In this emergency, the patient should immediately leave the bed, and put his limbs in motion.

The analogy between this sense of numbness and that which is premonitory of age, is remarkable in two respects. Both are aggravated by atmospheric changes, and are likewise effectually relieved by exercise. Closely allied to the foregoing is

*The sense of drowsiness.*—The predisposed to apoplexy or palsy are liable to fall asleep. The tendency to do so is sometimes so strong as not to be resisted even in company. In the midst of lively conversation, perhaps in a half finished sentence, the unfortunate patient loses his consciousness for a moment. This sense of drowsiness, like the other premonitory symptoms, commences in the peripheral brain. This position, we admit, accords not with the generally received opinion, which is, that sleep results from changes first occurring in the encephalon or brain proper. As the postulate which we have assumed has an important bearing upon our theory, we deem it of consequence to have it settled on correct principles. To ascertain them, let us examine the phenomena of sleep. When drowsiness approaches, the face becomes flushed, and the eyes red; a sense of heaviness settles on the brows, and extends over the whole head, as the disposition to sleep increases. Presently the eye-lids close, the mouth opens, the saliva drivels, the jaw drops, and the head falls upon the breast. The process, more and more intensified, extends throughout the system, reaches and completely asserts its sway over that portion of the peripheral brain appropriated to the muscles of animal life, when the subject reclines, or sinks into the recumbent posture. But why, it may be significantly asked, does the central brain cease to act? We answer, simply because it has nothing to do—the avenues of thought and volition are shut and sealed. But this does not answer the question pathologically. What is it that renders sleep necessary? Activity—action of muscle and of mind—especially the former—which implies a contraction of the capillaries—not of the organs of motion only, but also of those of sense; which contraction is followed by a spontaneous relaxation, usually commensurate

with the previous contraction. When this relaxation has gone on to a certain extent, the senses, closed against sensation, take no cognizance of changes, and consequently send no missions to the central brain, in which a similar condition has been subsequently, perhaps simultaneously effected, by which the functions of animal life are suspended. This state may constitute perfect sleep only; or more—profound coma. The first link in the chain of causation is, as has been suggested, an unequal distribution of blood to the ultimate or distal nerve fibres (peripheral brain) which compresses them; and the next, compression of the proximal extremities of the fibres of the same nerves.\* If any of the capillary vessels, meandering in the vesicular substance† of the encephalon, give way, hemorrhage and apoplexy result.

This relaxation is an ultimate law of nature, and therefore inevitable. Hence “exhausted by watchings, the soldier slumbers at the cannon’s side—the slave under the whip, and the criminal in the midst of torture;” and “sleep, tired nature’s sweet restorer,” must be had; but it is widely different from the premonitory drowsiness of which we are speaking—which is removed or counteracted by exercise. Every body is familiar with the utter incompatibility which exists between these two conditions—exercise and drowsiness.

\* “Every nervous filament (and this is a fundamental point of anatomy) has its central extremity in the cerebro-spinal axis and its peripheral extremity at its point of termination.”

\* \* \* \* \*

“Hence the central extremity of each fibre is connected with the peripheral extremity of a single nervous fibre only; and this peripheral extremity is in direct relation with only one point of the brain,” &c. \* \* “So that, corresponding to the many millions of primitive fibres which are distributed to the peripheral parts of the body, there are the same number of peripheral points of the body represented in the nervous centres.”—*Kirk & Paget*, p. 279–80.

(The reader will please excuse this repetition.)

† The vesicular nervous substance gives to the part, wherever located, the grayish or reddish appearance. It in fact constitutes the cineritious matter of the brain, &c. in which it is probable the nerve fibres terminate when they enter a nervous centre, or from which, in common anatomical parlance, they originate.

*Vertigo and dizziness* is often a premonitory symptom of apoplexy or palsy of much importance. Taken in connection with others, likewise present, its import cannot be easily misapprehended. When it occurs, the patient either falls or inclines to fall—does so, or instinctively lays hold on some object for support. Having done this, and retaining his hold, he should put one or another of his limbs in motion, which we believe invariably removes the difficulty. Moreover, this symptom, like the others, is prevented by suitable exercise; which should be practiced by those much afflicted by it, a short time before leaving the house, because they are most liable to experience it when abroad, especially in a street or crowded thoroughfare. This is owing to the fact that people are in the habit of maintaining their equilibrium and perpendicularity by the sense of vision; and dizziness results when the sight is impaired, or rendered indistinct by a multitude of objects in motion. Upon the same principle, this symptom is often experienced when the perceptive powers of the retina are becoming less active. In which case, it should be regarded merely as a sign of general declension, incident to age. In such instances, individual perceptions are too indistinct to enable the patient so to adjust the action of the muscles in other parts as to maintain his equilibrium.

As these afflictions may be induced by various causes—by inordinate use of tobacco and other narcotics, by anemia, sudden change of posture, &c.—they are not, therefore, always or even generally premonitory of palsy or apoplexy; yet their pathology (a deranged condition of a portion of the peripheral brain belonging to some one or other of the organs of sense, or pertaining to the muscles of animal life, or involving both) may in every instance be somewhat analogous. Accompanying sensations or circumstances will, it is believed, enable the experienced and skillful practitioner to discriminate and affirm that they are or are not premonitory of disease.

*Pain in the head*—Especially if accompanied by vertigo,



coming on in advanced life, and unattended with other affections commonly associated with it, is ever a portentous symptom, and demands the closest attention. It may be only an equivocal sign of cerebral affection, or it may be, as it is exceedingly apt to be at this time of life, the precedent of grave disease of its locality, whether within or without the cranium, or in a particular part or extending over the whole head with other symptoms, as nausea, constipation, sense of numbness, &c. &c. should be taken into consideration in order to settle the question whether it is premonitory or not. If premonitory, it is like the others removed by exercise, which should be gentle at first, and its effects, particularly in respect to its increase or continuance, be strictly watched.

*Difficult mastication, deglutition, &c.*—In hemiplegia, the action of the symmetrical muscles belonging to the face, tongue, fauces and glottis, is disturbed, and the parts with which they are connected, drawn to the well side; hence the difficulty of mastication, deglutition, articulation and respiration. In the performance of most of these functions, and particularly that of deglutition, if the attention of the patient be directed to the subject, he will soon discover that the difficulty is mainly on the affected side; because the muscles on that side, having lost the power of motion, and in some degree that of sensation, do not therefore resist the action of those on the well side. Consequently, when the attempt to swallow is made, the matter to be swallowed is forced over upon the disordered parts. Hence the assistance which is so generally derived from the application and pressure of the hand on the side of the face and neck, when the patient wishes to facilitate these operations. Deglutition, when premonitory of cerebral affection, of paralysis in particular, is often attended with a gurgling noise.

*Constipation and retention*, like those just mentioned, are symptoms which in paralysis arise from loss of sensation as well as from loss of motion. The primary sensation which naturally prompts the bladder and rectum to employ them-

selves, is experienced at the terminal outlets of these viscera, and of course belongs to animal life.\* It produces the conviction that it is occasioned by something which the economy of the system requires to be removed, and also that these viscera are the organs by which its removal is to be effected; i. e. by the passage of their contents. But if this sensation be not experienced, they will make no effort for the removal of a cause, the existence of which, so to speak, they are not aware.† The rectum and bladder are organs of a complicated structure. Each has striated and non-striated muscular fibres and also nerves in its composition, which belong to both animal and organic life, and are therefore organs whose functions, like their structure, are of a mixed nature—partly animal, partly organic. In their normal state, they respond to two kinds of stimuli, the mechanical and chemical, which may act either conjointly or separately, each *per se*.‡ The susceptibility to these stimuli is modified by the condition of the organs at the time as it is healthy, irritable, insensible, or merely obtuse. Now, the cause which in this affection deprives the patient of the sensation to which we have alluded, also paralyzes the striated and in some degree the non-striated muscles, and constipation and retention, as necessary results, soon follow and continue for a time, when they are succeeded by involuntary discharges of urine and fæces. These phenomena, and the succession in which they occur, we explain in this way: The contents of the bladder and rectum, probably somewhat altered in their consistence and chemical properties, continue to accumulate, unconsciously to the patient, until the mus-

\* I cannot call to mind a single case of paralysis of motion, with unimpaired sensation, in which there was incontinence of urine, or unconscious discharge of fæces.

† “The intestinal ganglia do not give out the nervous force necessary to the contractions of the intestines, except when they receive through their centripetal nerves the stimuli of substances in the intestinal canal.”

‡ “The contents of the rectum and bladder acting as stimuli, produce a certain impression on the nerves of those viscera, which impression is conveyed through them to the adjacent ganglia of the sympathetic.”

cles, supplied with nerves from the ganglionic system, are put upon the stretch and stimulated to contract, expel the contents of these organs, without the control or even knowledge of the patient.\*

These events, and the order in which they happen, are more remarkable in cases of paraplegia than in those of hemiplegia. In both, the retention, &c. are equally certain; but in the latter (paraplegia), the involuntary discharges usually take place sooner than in the former; and the explanation requires to be somewhat modified. In hemiplegia, the muscles controlling the outlets of the rectum and bladder are affected like the muscles of the face. Consequently, when these organs contract, analogous results ensue—the muscles of one side only are affected, while those of the other side are intact. The consequence is readily understood. The parts, as in paralysis of the face, are drawn to the well side, and the apertures are either opened, or afford no resistance whatever on the diseased side to the passage of the contents of the viscera, which come away unresisted and unheeded by the unfortunate patient.† Sometimes, however, in hemiplegia these involuntary discharges are preceded by a complete obstruction, while in paraplegia the involuntary discharges generally commence almost immediately without being preceded by either retention or constipation. When retention of urine results from an injury of the spinal marrow, it is commonly removed by one or two introductions of the catheter; but incontinence soon intervenes. When the palsy is caused by a mineral poison,

\* “Ordinarily, the contents of the rectum and bladder, acting physically on the mucous membrane, or mechanically, i. e. by distention of their muscular coats, make an impression, which prompts them to contract and expel the contained matters.”

† The inconvenience from these involuntary discharges may be in some measure obviated or lessened, by keeping the inferior extremities extended in a line with the trunk, and the nates drawn together by the application of long and broad strips of adhesive plaster, or by the uniting bandage skillfully applied. These mechanical appliances give the support which would be derived from the muscles were they intact.

as lead, or by malaria, incontinence of urine and involuntary discharges from the rectum seldom if ever occur—a circumstance which should be taken into the account when making up a diagnosis in obscure cases.

It may be well to remember that only the fore mentioned, and nearly all the positive as well as premonitory symptoms of apoplexy and palsy, whether of sensation or motion, have their seat in the termini which constitute the peripheral brain; and that the premonitory symptoms of these formidable diseases—as sense of coldness, numbness, drowsiness, pricking, formication, and lastly, twitches, cramps and spasms—invariably occur first in these termini. The five first mentioned are sent by way of admonition, and the last three as preventives, and also as a solemn intimation that the real attack is near at hand. These involuntary movements are, moreover, the suggestions of nature as to what ought to be done; that the patient should without delay have recourse to exercise; that whenever any of these premonitions are present, he should exert the limb with energy, instead of rubbing or having it rubbed, as is usually done. He should be advised of his danger, and assured that the course suggested will not only put a stop to the unpleasant feelings, but prevent the accession of the disease of which they are the precursors and heralds.

This method was adopted and practiced by Kanski, when threatened, as he frequently was, by other attacks; which were always obviated, as we assured him they would be, by this expedient. We desire to speak of this method of treatment somewhat emphatically and positively, because we have, for a long and tolerably extensive practice, found it uniformly successful, when connected with other proper hygienic measures. But what has impressed us the more deeply in favor of its importance, is our own personal experience, having been at one time or another affected with all the premonitory symptoms—even the cramps and spasms—which were invariably and certainly removed by strenuous and persistent action. The cramps and spasms to which we



have alluded sometimes terminate in epilepsy instead of apoplexy or palsy; in which case, the preventive remedy (exercise) is the same, and is equally efficacious and successful.\*

These affections of the muscles, like convulsions, constitute the efforts of nature; the design of which, by driving blood to the muscles, is to relieve the brain or nervous centres from the imminent danger with which they are menaced. The principle is the same in disease as in health. In taking this view, we must not forget that the exercise of the muscles, both in health and disease, may be carried so far as to increase the circulation in both force and frequency, and so produce or aggravate the very evil which it was intended to prevent. Hence the necessity of caution. Depletion, abstemious diet, &c. may sometimes be with great propriety superadded.

### *Decline of Life.*

“As age steals on, all the functions are performed more languidly than in earlier life. The energies of the ganglial system decline, as evinced by the digestive, circulating and secreting functions which it actuates. The sensibility of the cerebro-spinal system, and its dependent organs; the acuteness of our intellectual powers, our moral emotions and affections; and the activity and strength of the locomotive

\* A medical gentleman, extensively engaged in the practice of his profession, but subject to frequent attacks of epilepsy, informed the writer that, conscious of the danger of having a fit when riding in his carriage or on horseback, he always sprang from the one or the other whenever he had the slightest intimation of the accession of a paroxysm, and sought a convenient place in which he could go through the struggle with safety, but that he had never been attacked when thus prepared for the assault—the demon never came! The explanation is, that the vigorous effort made to procure the place of safety, prevented the fit. This, I believe, will generally prevent the fit in cases in which the aura gives timely notice, and the patient has the resolution to put it in practice. When the fits are periodical, they should be anticipated by exercise—and particularly when they occur during sleep, towards morning, the patient should be aroused, and made to exercise.

organs—all experience diminution, great in proportion to the advances of age.”—*Copland*.

The premonitory symptoms which have been mentioned, are not unfrequently signs of approaching age, as well as of disease, and are then almost as certainly and effectually met by gymnastic exercises, as they are when premonitory of disease. In connection with exercise, they are, in this point of view, worthy a more extended and thorough consideration than we can give them, except in illustration of our subject. With the symptoms and phenomena of approaching age all are familiar. We therefore beg leave to state that observation and experience have forced upon us the conviction that most of them may be obviated and prevented, to a certain extent, by persevering in a consistent course of gymnastic exercises. It will prevent the rigidity of the fibrous structures, also their ossification, and add to the muscles what is lost by the areolar tissues in the decline of life. By giving strength to the muscles, it prevents the slow, vacillating and embarrassed movements of the aged. By often contracting the dorsal muscles, which curve the body backward, stooping is resisted and prevented; and also likewise the consolidation and thinning of the fibro-cartilaginous substances, interposed between the bodies of the vertebræ, by which this proclivity of the body forward and downward is favored. Determining more blood to the brain and quickening its circulation, increases its nutrition, and consequently prevents the atrophy of this organ, which results from age, and also sustains its functional powers, both mental and physical. By throwing more blood upon the heart, it keeps up its volume, consistency, tone and action, and on the same principle, continues to invigorate the stomach and preserve the viscera in healthy and vigorous performance of function.

There is, in advanced age, very much the same indisposition to muscular effort as in paralysis, and is the more difficult to overcome when paralysis and age concur in the same individual. The aged, like the paralytic, instinctively loves to be quiet, and consulting his ease, foregoes exertion of

body and mind. Remiss in attention to objects of sense, his organs lose their acuteness of perception, and languish and fade from inactivity. The eye grows dim, the ear heavy, the touch benumbed and the muscles shrink and stiffen, for want of exercise. When the joints become rigid and motion irksome or painful, especially in the morning, or indeed at any time of day, instead of giving up or yielding to the promptings of inclination, we should immediately commence upon a system of gymnastic exercises, and continue them for the time being, till the joints become supple and the muscles cease to complain. If this advice be taken and followed to the letter, the matutinal dose will probably suffice for the day. But, we add, whenever the contingencies mentioned recur, the remedy should be repeated, by which we are quite certain the ordinary infirmities of age may be obviated or postponed for years.

P. S.—The cases related in this paper were all, except the first, treated at the New York hospital, under the daily supervision and approbation of Drs. Griscom, J. M. Smith and Bulkley, who constituted the medical staff in attendance while these patients were under treatment. To these gentlemen, and also the governors, I am under special obligation for the liberality and efficiency with which they seconded my views and efforts. I am likewise much obliged to the gentlemen on the surgical side of the house, for sending to me several cases, in which it will be seen surgical practice was not a little interested. I have preferred, in this publication, cases treated in a public institution, to those which have occurred in my private practice, for the reason that the former were subjected, in the progress of cure, to the daily inspection and observation of the attachés, and many others who visited the hospital in the capacity of either practitioners or students. The first case having gained considerable notoriety by being exhibited to several of our public institutions, is not regarded as forming an exception.



## ERRATA.

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Page 13, line 32, for "pus," read "fæces."

Page 14, line 16, for "he," read "I."

Page 14, line 17, for "hand," read "his hand."

Page 14, line 18, for "his," read "my."

Page 14, line 23, for "afflicted," read "affected."

Page 20, line 36, for "reconciled," read "reconnected."

Page 26, line 6, for "occasion," read "occurrence."

Page 32, line 35, for "afflicted," read "affected."

Page 39, the whole paragraph, beginning at "Peripheral Brain," italic head, should have been quoted, in a foot note.

Page 39, line 19, for "remific," read "sensific."

Page 49, for "affected," read "applied."

Page 50, line 11, for "leg," read "legs."



